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A STUDY OF THE ETIOLOGY, NATURE AND INCIDENCE OF INJURY IN THE 1988 AUCKLAND DIVISION I SENIOR CLUB RUGBY COMPETITION

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled, "A Study of the Etiology, Nature and Rate of Injury in the 1988 Auckland Division I Senior Club Rugby Competition", submitted by Nicholas Ewart in partial fulfilment of the requirements for the degree of Master of Science in Physical Therapy.

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DEDICATION

This thesis is dedicated to my mother and father

ABSTRACT

The purpose of this study was to examine the etiology, nature and incidence of injury in the 1988 Auckland Division I Senior Club Rugby Competition in New Zealand. The sample consisted of approximately 250±20 Senior Club rugby players representing their respective teams in the Division I Senior Club Rugby Competition. Games were played every week for the duration of the 20 week season, beginning in mid-April and ending in early August of 1988.

A rugby injury was said to have occurred when a player missed a full practice following the preceding Saturday's game. A rugby injury report form was developed by the author from which information relevant to rugby injuries could be collected and analysed. The Rugby Injury Report Forms were completed by each injured player in conjunction with the doctor, physiotherapist or trainer associated with each club team.

Sixty injuries (representing an overall injury incidence of 24%) were reported. The data showed that forwards were injured more frequently than backs. Tighthead props and openside flankers were the two positions with the highest incidence of injury. The

tackle proved to be the phase of the game with the highest incidence of injury. More specifically, being on the receiving end of a tackle resulted in a higher incidence of injury than performing a tackle. The lower limbs were the most common site of injury. The most common type of injury was ligament sprains, followed closely by muscle or tendon strains.

The results of this study tended to support suggestions in the literature, that measures such as pre-season conditioning programs, increased flexibility work, specific muscle group strengthening and improvement of tackling technique, may lower the incidence of injury in rugby.

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TABLE OF CONTENTS

CHAPTER		PAGE
I.	STATEMENT OF THE PROBLEM	1
	Introduction	1
	The Problem	2
	The Need for the Study	2
	Delimitations	3
	Limitations	3
	Definition of Terms	4
	Player Positions in Rugby	6
II.	REVIEW OF THE LITERATURE	8
	The Incidence of Rugby Injuries	8
	The Nature of the Rugby Injuries	16
	The Etiology of Rugby Injuries	24
	Summary	27
III.	METHODS AND PROCEDURES	30
	Methods	30
	Procedures	32
	Data Analysis	32
IV.	RESULTS	34
	Incidence	34
	Age and Previous Senior Club Rugby Experience	34

CHAPTER PAGE

Height and Weight of the Injured Players 35

Playing Position 35

Body Regions Injured 36

Type of Injury 37

Relationship Between Site and Nature of Injury 37

Relationship Between Specific Activity Resulting in Injury and Type of Injury 37

Specific Activity Resulting in Injury . . 37

Relationship Between Playing Position and Type of Injury 38

Stage of Season and Game 39

Field Conditions 39

Aggravation of Previous Injury 40

Use of Mouthguards 41

First Aid 41

Provision of Initial Assessment and Treatment of Injury 41

V. DISCUSSION 42

Incidence of Injury 43

Player Characteristics 43

Playing Position 44

Body Regions Injured 45

Type of Injury 46

Specific Activity Resulting in Injury . . 48

Stage of Season and Game 49

CHAPTER PAGE

Field Conditions 50

Playing Position Related to Type of Injury 51

Type of Injury Related to Site of Injury 53

Specific Activity Resulting in Injury Related to Type of Injury 53

Provision of Initial Assessment and Treatment of Injury 55

Use of Mouthguards 55

Practical Implications 56

Suggestions for Further Study 57

Recommendations 58

VI. SUMMARY AND CONCLUSIONS 60

Purpose 60

Conclusions 62

BIBLIOGRAPHY 64

APPENDIX A. RUGBY INJURY REPORT FORM 69

APPENDIX B. RUGBY INJURY REPORT FORM INSTRUCTIONAL PAMPHLET 73

LIST OF TABLES

TABLE		PAGE
I	Players at Risk According to Playing Position [from Murphy and Shuttleworth (26)]	10
II	Injury Frequency by Position [from Roy (35)]	11
III	Injuries per 10,000 Player Hours at Rugby School [adapted from Sparks (29)]	12
IV	Overall Incidence of Rugby Injury in the Different Playing Position, Occurring at 26 South African High Schools in 1987 [from Roux et al (34)] .	17
V	Classification of All Injuries [from Nathan et al (29)]	18
VI	Hierachy and Type of Injury and Bodily Sites [from Murphy and Shuttleworth (26)]	19
VII	Percentage of Rugby Injuries Occurring at Different Body Sites [from Sparks (38)]	20
VIII	Relationship Between the Site and Nature of Injury in Rugby [adpated from Myers (28)]	22
IX	Relative Incidence of the Different Types of Injury [from Roux et al (34)] .	23
X	Summary of Contextual Mechanisms of Injury in Rugby Competition [from Reilly and Hardiker (32)]	25
XI	Incidence of Injury During the Different Phases of Play (from Roux et al (34)]	26

TABLE		PAGE
XII	Injuries per 100 Athletes per Year [from Smodlaka (37)]	28
XIII	Frequency of Injury Related to Playing Position in Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season	36
XIV	Frequency of 60 Injuries Related to Body Region in Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season	36
XV	Frequency of Different Types of Injury Sustained by Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season	37
XVI	The Relationship Between the Site of Injury and Nature of Injury in Rugby Players Injured in the 1988 Auckland Senior Club Rugby Season	38
XVII	Frequency of Injury Related to Specific Activities Resulting in Injury in Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season . . .	39
XVIII	Frequency of Injury Related to Stage of Season for Rugby Players Injured During the 1988 Auckland Senior Club Rugby Competition	40
XIX	Frequency of Injury Related to Stage of Game for Rugby Players Injured During the 1988 Auckland Senior Club Rugby Competition	40
XX	Frequency With Which Various Team Personnel Provided Initial Assessment and Treatment of Injuries Sustained by Players During the 1988 Auckland Senior Club Rugby Season	41

CHAPTER I. STATEMENT OF THE PROBLEM

Introduction

There is a risk of injury associated with the participation in any sport. The risk of injury increases if the sport is a contact sport.

In 1846 at Rugby School in England, the rules of the game of rugby were published. In 1871, the Rugby Football Union was formed in Britain, and the first International or "Test Match" was played between England and Scotland. Rugby Union was briefly an Olympic sport in 1920 and 1924, and on both occasions, the Gold Medal was won by the United States of America. Today, the governing body of rugby is called the International Rugby Board. Rugby is currently played in more than 50 countries worldwide and its popularity is increasing, especially in the wake of the highly successful inaugral World Cup recently held in Australia and New Zealand.

Another reason cited for the increasing popularity of rugby is that it is far cheaper to outfit a youngster for schoolboy rugby than it is for North American football. This point raises a noteworthy feature regarding the game of rugby in that essentially no protective equipment is worn by the players. Some front-row forwards wear shin guards. No player wears a

helment, shoulder pads, or protective equipment of any nature. In fact, the rules of the game prohibit the use of shoulder pads unless the player has a medical problem requiring their use. Even then, they must be of a very lightweight nature. Mouthguards may be worn. As yet, their use is not compulsory, although two authors actively encourage their use (6,7).

Perhaps because of the lack of protective equipment worn, in some quarters, rugby has developed the reputation as a dangerous sport for adult players and, in particular, schoolboy players. It has even been suggested that the game of rugby should be abolished.

In light of the above, it seemed necessary to investigate further the etiology, nature and incidence of rugby injuries.

The Problem

It does appear that the game of rugby does involve a higher risk of injury than most other sports due to the rules and nature of the game (37). Thus, the purpose of this study was to look closely at the etiology, nature, and incidence of injury in the 12 Senior Club Rugby teams competing in the 1988 Auckland Division I Championship in New Zealand.

The Need for the Study

A comprehensive review of the relevant literature pertaining to the etiology, nature, and incidence of

rugby injury revealed a number of survey studies on schoolboy rugby injuries. In contrast, the literature search revealed relatively few studies of any type looking specifically at injuries sustained by adult rugby players. Further to this, to the best of this author's knowledge, there was no study published which looked at the nature and incidence of injury of a full division of teams for the length of a competitive season.

Thus, there was a need to develop a simple, easily understood, yet comprehensive Rugby Injury Report Form from which information relevant to rugby injuries could be collected and analysed.

Delimitations

A number of restrictions were placed on both the sample and the study. The delimitations were:

1. The study was restricted to the 1988 Rugby season which was 20 weeks in duration,
2. The sample included players comprising the 12 teams in the Auckland Division I Senior Club Rugby competition in New Zealand.

Limitations

In addition to the delimitations listed previously, it was expected that limitations would arise as the study progressed. These limitations included the following:

1. Only those rugby players who missed a practice, due to a rugby injury, were considered.

2. It was assumed, that despite the Rugby Injury Report Form being simple and concise, some respondents might have misinterpreted some areas of the form, and by doing so gave incorrect or inaccurate information.

3. It was assumed that the diagnosis and injury information received from the player, coach and/or trainer was correct.

4. Those players who sustained an injury during practice were not considered for this study.

Definitions of Terms

A Reportable Injury. A reportable injury was one which necessitated the injured rugby player to miss a full practice due to the injury sustained.

Etiology of Injury. The cause of the injury. Generally, the etiology given reflected the opinions of the injured rugby player.

Nature of Injury. The actual injury sustained in the rugby accident, for example, ankle sprain, facial laceration, fractured finger.

Trainer. A trainer provides assistance in the prevention, management and rehabilitation of injuries, but does not have a medical or physical therapy qualification.

Scrum. The scrum is the first of the two basic set pieces of the game of rugby. The scrum is formed by the two forward packs of eight men each, binding together with their arms, bending forward at the waist and pushing against each other. Each pack comprises 3 rows of men, namely 3 in the front row, 4 in the second row and 1 man in the back row. The ball is placed into the tunnel formed between the two opposing front rows, and the hooker from each side tries to hook the ball back with his feet.

Line-out. The line-out is the second of the two basic set pieces. The line-out is the method of bringing the ball back into play once it has crossed the sideline. The two forward packs line up in single file adjacent to one another and the ball is thrown between the two lines so it can be jumped for, much the same as in a basketball toss-up.

Ruck. The ruck consists of both forward packs competing for the ball. The players use their feet to scrape or rake the ball clear, so the halfback can pass the ball out to the backs.

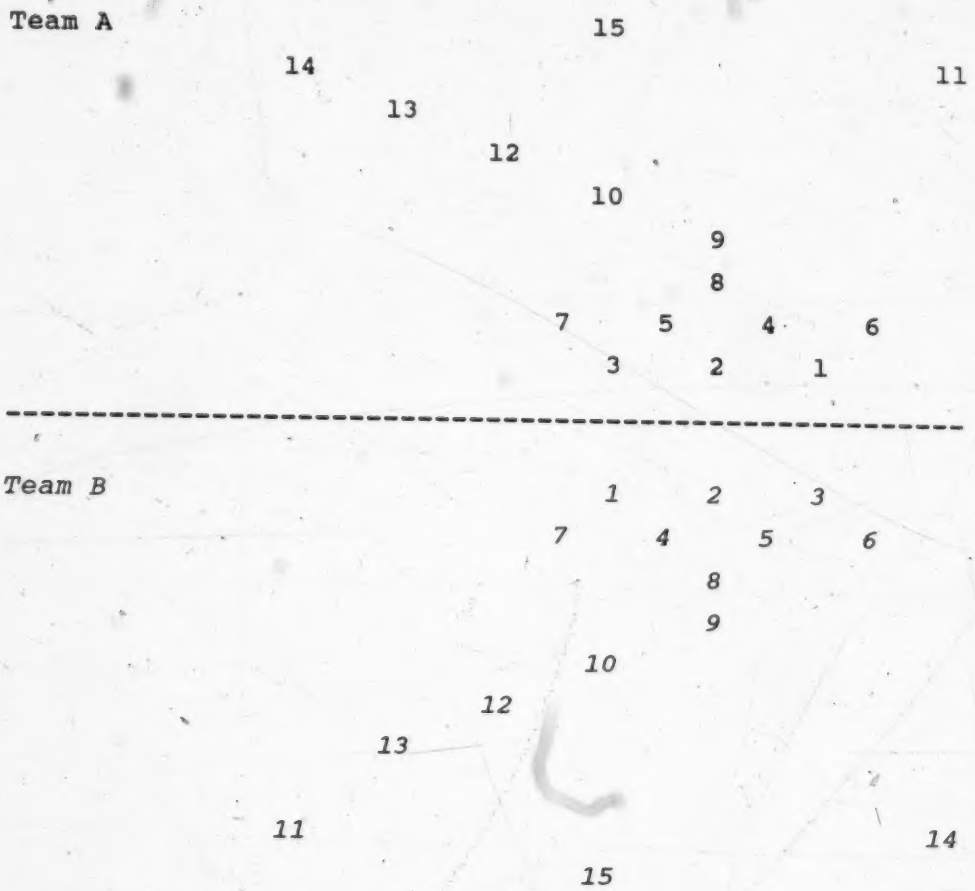
Maul. The maul consists of both forward packs competing for the ball, but in this instance, the forwards are using their arms to wrestle the ball free from the opposing team to give it to their halfback.

Auckland Division I Senior Club Rugby. Division I Senior Club Rugby is the highest level of club rugby in

Auckland. The level of rugby above club play is provincial representative rugby, for which all club players are eligible. The highest level of all is national representation, where international play takes place. The national team is chosen from the players participating in either Division I Senior Club Rugby Competition or Provincial Representative play.

Player Positions in Rugby

In Rugby, the numbers the players wear is standard and consistent in position as appears below:



Player numbers related to position played are as follows:

Forwards

1: Tighthead Prop
2: Hooker
3: Loosehead Prop
4: Left Lock
5: Right Lock
6: Blindside Flanker
7: Openside Flanker
8: Number Eight

Backs

9: Halfback
10: First Five-eighth
11: Left Wing
12: Second Five-eighth
13: Centre
14: Right Wing
15: Fullback

II. REVIEW OF THE LITERATURE

The review of the literature is presented under the following headings:

(i) The Incidence of Rugby Injuries

(ii) The Nature of the Rugby Injuries

(iii) The Etiology of Rugby Injuries

A summary of the findings follows these topics.

The Incidence of Rugby Injuries

The incidence of injury in rugby is addressed in the literature in two ways: (1) the overall incidence of injury in rugby, and (2) the incidence of injury related to the position played is discussed.

Walkden (42) looked at all rugby injuries occurring at Twickenham Rugby Ground in England from 1964-1975. He calculated that 10% of the players who played on that ground over the ten seasons sustained an injury. This figure may seem high, but he included all lesions in his calculations, such as sutured cuts, lacerations and extramuscular hematomas. If only severe injuries are considered, Walkden found 1.7% of the players received a severe injury. The injuries included fractures, head injuries requiring overnight detention in hospital, and

joint lesions requiring further orthopedic management. Walkden felt the severe injury rate of 1.7% compared favourably with the incidence of severe injuries in other sports. Walkden identified the half-back (13.5%), the hooker (9%), the first five-eighth (9%) and the full-back (8%) as being the most commonly injured players. Conversely, he found the wings to be injured least often (3.5%), although towards the end of the study, their injury rate had risen to 5.5% of all injuries seen. He hypothesized this increase in injury rate may have occurred as efforts were being made to include wings in general play more, especially on defence, when they were encouraged to cover for the full-back.

Nathan, Goedeke and Noakes (29) examined the incidence and nature of rugby injuries occurring at a South African school over the 1982 season. The overall incidence of injury for the 10 - 19 year old boys was one injury sustained for every 395 "boy-hours" of rugby (i.e., 15 boys playing rugby for 1 hour equals 15 boy-hours of rugby). This figure included both match and practice injuries. If only the matches themselves were considered, the incidence of injury was 1 injury for every 119 boy-hours of match play. In addition, the authors found a much greater incidence of injury among the high-school players (over 14 years of age) as

compared to the junior-school players (14 years of age and under). When the percentage of injuries suffered by players in different positions was examined, it was found that hookers (31.6%), full-backs (14.7%) and number-eights (12.6%) were injured most frequently. Nathan et al found the props (2.1%), locks (4.2%) and the wings (4.7%) to be injured the least.

Murphy and Shuttleworth (26) published a study which examined the risk factors associated with rugby injuries. They did not address the subject of incidence of rugby injury, but did discuss earlier work by Roy (35) and Durkin (11) that examined the incidence of injury according to playing position. Specific figures were not given, but the results were presented in Table I.

Table I
Players at Risk According to Playing Position
[from Murphy and Shuttleworth (26)]

Rank Order of Risk	Roy (35) (1974) Playing Position	Durkin (9) (1977) Playing Position
1	No. 8	Full-Back
2	Flanker	Centre
3	Lock	No. 8
4	Hooker	Wing
5	Wing	Flanker
6	Full-Back	First Five-Eighth
7	Centre	Prop
8	Prop	Hooker
9	First Five-Eighth	Half-Back
10	Half-Back	Lock

Based on the above results, Murphy and Shuttleworth concluded that overall, forwards were injured more frequently than backs.

Roy (35) published a study in 1974 based on 300 rugby injuries that occurred during the 1973 season at Stellenbosch University in South Africa. In a similar fashion to Murphy and Shuttleworth, Roy did not discuss overall incidence of injury in rugby based on his findings. However, he did look at the injury frequency by position and presented the information in Table II.

Table II
Injury Frequency by Position
[from Roy (35)]

Position	Percentage (%)*
Number 8	14.0
Flanker	11.0
Hooker	11.0
Lock	11.0
Wing	10.5
Fullback	9.5
Centre	9.0
Prop	9.0
First Five-Eighth	8.5
Halfback	7.0

*Roy's percentages totalled 100.5%, as he has rounded each percentage to the nearest 0.5%.

As can be seen, the injury frequencies by position were relatively even compared to other studies reviewed, with the noteworthy features being that the number 8

(14.0%) was injured most frequently, and the half-back (7.0%) least frequently.

In 1981, a study by Sparks (38) was published that examined rugby injuries afflicting schoolboys at Rugby School over a 30-year period. Based on 9,885 injuries seen, the overall incidence of injury was 197.7 injuries per 10,000 player hours. This incidence is equal to one injury every 50.6 player-hours, and is considerably higher than that cited by Nathan et al previously. Sparks compared the injury rate for rugby with the injury rates for other sports at Rugby School. He concluded that not only was the incidence of injury highest in rugby, the injuries were of a more varied and severe nature as compared to those sustained in cricket, field hockey, cross country running, athletics, squash, tennis, basketball and badminton as shown in Table III.

Table III
Injuries Per 10,000 Player Hours at Rugby School
[adapted from Sparks (29)]

Sport	Injuries/10,000 Player Hours
Rugby	198.0
Basketball	103.0
Cross-Country Running	37.0
Cricket	33.0
Field Hockey	27.0
Athletics	26.0
Squash	10.0
Tennis	7.0
Badminton	5.0

Sparks did not discuss the incidence of schoolboy rugby injury related to playing position.

Reilly and Hardiker (32) examined two adult student rugby teams over a 20 week competitive season. They determined an overall incidence of injury of 9 injuries per game. Considering there are only 30 players involved in a game, this rate of injury at first glance appears extremely high. However, the authors went on to say that 1.7 "serious" injuries were seen per team, or one serious injury for every nine player exposures. In addition, Reilly and Hardiker found the full-back (14.3%) and flankers (13.3%) to be the most commonly injured players. The player positions that sustained the least injuries were the wings and locks, each sustaining 6.9% of the total injuries. The results of Reilly and Hardiker's study regarding the nature and rate of rugby injuries sustained by the two adult student rugby teams they examined, are open to interpretation, as only 30 players were followed over a full season. In contrast, Spark's study had a potential population of 4,500 schoolboys.

Davidson (8) examined schoolboy rugby injuries from 1969 to 1986 at an Australian College. Over this time-frame, 1,444 injured boys were seen and the calculated incidence of injury was 176 injuries per 10,000 player-hours. This incidence of injury compares

favourably with Spark's figure mentioned earlier (ie. 197.7 injuries per 10,000 player-hours). Davidson also published a rate based upon his results, of 14 severe injuries per 10,000 player-hours. Two of the 116 severe injuries seen were further categorized as clinically serious, as one was a fractured skull, and the other a fracture-dislocation of the cervical spine. Davidson found the full-back (8.6%) to be the most commonly injured player and the prop (6.7%) to be the least injured player.

The results of a prospective study looking at rugby injuries in Christchurch, New Zealand during the 1979 rugby season was published in 1981. The authors, Inglis and Stewart (17), did not discuss the overall incidence of injury they observed. However, they stated that the flankers and wings were most commonly injured, whereas the hookers and full-backs were the two positions least commonly injured.

Myers (28), in a study similar to that of Walkden's (42) discussed earlier, examined rugby injuries occurring at a specific ground over a certain period of time. He chose Ballymore Oval in Brisbane as the site of his study for the 1979 rugby season. Three hundred and forty-seven injuries were seen and the calculated rate of injury was 1.23 injuries per game.

The games played at Ballymore that season were varied, in that representative matches, as well as first, second, third, fourth and fifth grade matches were all played. It was found that the incidence of injury varied with the grade of play, with the highest incidence being recorded in representative matches. The first five-eighths (3.3%) and locks (4.5%) were the least frequently injured players in Myers' study. The players in the most danger were the full-backs and flankers, receiving 9.5% and 8.8% of all injuries sustained respectively.

An extensive study was conducted in three Australian States over the 1981 rugby season. Thirty-three schools were selected from the three States and data concerning rugby injuries were gathered. The overall injury rate was 0.98% per player-game which the author, Sugerman (39), concluded was very low, considering the nature of the game and the hard grounds so prevalent in Australia. No one position proved to be significantly more prone to injury than any other. Again, as discussed in studies reviewed earlier, Sugerman found the incidence of injury to increase with the age of the schoolboys. He hypothesized this increased incidence of injury was due to an increase in the muscle bulk, speed, power and momentum of the boys as they matured.

An extensive study by Roux, Goedeke, Visser, Van Zyl and Noakes (34) looking at the epidemiology of rugby injuries occurring at 26 South African High Schools, was published in 1987. The overall incidence of injury found was 1 injury for every 142 boy-hours of match play. Roux et al compared this injury incidence of 1 injury for every 142 boy-hours of match play to the injury incidence of 1 injury every 84 hours of match play found in a similar study by Nathan, Goedeke and Noakes (29). Roux et al stated that the difference in injury incidence between the two studies was due to the problem of under-reporting in their recent study, and hence, the results published by Nathan et al were more accurate. Roux et al said they felt close monitoring of one school resulted in the most accurate injury reporting. The data from their study is presented in Table IV.

They also included the data from Nathan et al's (29) study in their table, as a source of comparison. The additional data from Nathan et al's is seen in parentheses. As can be seen, there were some large discrepancies between the two sets of results.

The Nature of the Rugby Injuries

Walkden (42) found that 20% of the total number of injuries he saw during the course of his study over 10 seasons were to the joints. The prime joints affected

Table IV
Overall Incidence of Rugby Injury in the Different Playing Positions, Occurring at 26 South African High Schools in 1987
[from Roux et al (34)]

Playing Position	Injury Incidence (%)*
Number 8	13 (12.6%)
First Five-Eights	12 (8.4%)
Wing	12 (4.7%)
Full-Back	11 (14.7%)
Center	10 (5.3%)
Flanker	10 (5.8%)
Half-Back	9 (10.5%)
Hooker	8 (31.6%)
Prop	8 (2.1%)
Lock	6 (4.2%)

*Roux et al did not explain why both columns of injury incidence percentages did not total 100%.

were the ankle, knee, glenohumeral and acromioclavicular joints. Musculotendinous lesions comprised 25% of the total injuries sustained, of which approximately 50% were hematomas. However, by far the most common type of injury was lacerations, comprising 34.5% of all injuries seen. Fifty-three percent of all lacerations required repair by suture.

Nathan, Goedeke and Noakes (29) found the schoolboy subjects in their 1982 study suffered the injuries as listed in Table V. The disturbing feature in Table V was the high number of concussions sustained by the schoolboys. However, the authors felt that the number of concussions present in their study was comparable to other study findings (8,38).

Table V
Classification of All Injuries
[from Nathan et al (29)]

	Number	Percentage*
Concussion	17	21.5
Muscle Injuries	17	21.5
Ligament Injuries	14	17.7
Fractures	12	15.2
Bone Bruising	6	7.6
Skin Lacerations	4	5.1
Joint Dislocations	4	5.1
Tendon Injuries	4	5.1
Ear Hematoma	1	1.3
TOTAL	79	100.1

*Nathan et al did not explain why the percentages of injuries did not total 100%.

Murphy and Shuttleworth (26) present no data of their own in their 1978 article. However, they reviewed the literature and produced a hierachy of injuries in rugby (Table VI). No supporting figures or references were given for the table presented, so the validity of the data cannot be determined by the reader.

The nature of rugby injuries seen by Roy (35) at Stellenbosch University was again notable for the high number of head and facial injuries (20.5%), consisting mainly of lacerations (60%). Only 10% of the head and facial injuries were concussions. This low incidence of concussions raises an interesting feature discussed earlier by Nathan, Goedeke and Noakes (29), that as the

Table VI
Hierachy and Type of Injury and Bodily Sites
[from Murphy and Shuttleworth (26)]

Type of Injury	Body Sites
(1) Lacerations/concussion	Head and face
(2) Fractures, soft tissue damage and ligament injury	Knee and ankle
(3) Dislocations	Mainly acromioclavicular and phalangeal displacement
(4) Muscle contusions	Quadriceps hematoma most common

average age of the studied players increased, the overall number of concussions seen decreased. This feature was supported by Roy's findings. The knee (14.5%) and the ankle (13.5%) were also commonly injured. However, Roy had a large group of injuries he classified as "Others". At no point in the article did he discuss the injuries included in this category, despite the fact that "Others" comprised slightly more than a third (35.5%) of all injuries that occurred during the study.

Sparks (38) presented his data collected over 30 seasons at Rugby School in a complete manner. One very detailed table of the frequencies of all the types of injuries he saw showed that, in descending order of

incidence; concussions, quadriceps strains, fractured phalanges and fractured teeth were the most common injuries seen. To give the reader an indication of the body sites most frequently injured, Sparks presented his data, along with that of 6 other authors in tabular form as shown in Table VII.

Table VII
Percentage of Rugby Injuries Occurring at Different Body Sites
[from Sparks (38)]

Author	Head and Neck	Upper Limb	Trunk	Lower Limb
Weightman and Browne (44) (1974)	30.6	22.1	11.6	35.7
Adams (1) (1977)	16.1	32.3	11.2	40.4
O'Connell (32) (1954)	23.8	31.2	11.2	33.8
Davies and Gibson (9) (1973)	24.5	22.5	10.6	42.4
Davidson (8) (1978)	37.9	28.3	6.5	27.3
Allemandou (3) (1971)	18.3	28.4	13.4	39.9
Sparks (39) (1983)	16.9	25.9	11.1	46.1

In summary, it can be seen that Weightman and Browne (43), and Davidson (8) record greater proportions of head and neck injuries. All the studies showed a low rate of injury for the trunk and all, with the exception of Davidson, showed more lower than upper limb injuries. The reason suggested by Sparks for this finding was that the grounds in Australia where Davidson conducted his study tended to be much drier and harder that those found in Britain, thus potentially predisposing to more cases of concussion and upper limb fracture.

Reilly and Hardiker (32), when discussing the nature of injuries seen in their study, concentrated more on the body part injured rather than the type of injury suffered. Overall the leg (32%), the head and face (18.9%), and the knee (14.8%) were most frequently injured. The authors did state that the most vulnerable sites of minor injury such as cuts, abrasions and contusions were the lower limb (54%), and head and face (21.2%).

Inglis and Stewart (17) found that of the injured rugby players presenting at the Christchurch Hospital Accident and Emergency department in New Zealand, most had relatively minor injuries, ie. lacerations (20%), bruises (19%) and various sprains and strains (32%). The authors stated that the most frequently seen injuries occurred to the head (31%) followed by the

lower limbs (no percentage figure was given for the lower limbs).

Myers (28) found a full 52% of the players injured in his study at Ballymore Oval in Brisbane, Australia, had suffered an injury to the head and neck. Lacerations were the most common type of injury afflicting the head and neck region. In addition, lower limb injuries (21%) and upper limb injuries (19%) were also regularly seen. Myers produced a table that related the site and nature of the injuries (Table VII).

Table VIII
Relationship Between the Site and Nature of Injury in Rugby
[adapted from Myers (28)]

	Number of Injuries at Various Sites			
Nature of Injury	Head and Neck	Lower Limb	Upper Limb	Trunk
Soft Tissue*	16	13	18	21
Laceration	93	7	6	--
Joint Sprain	--	35	12	--
Dislocation	--	2	7	--
Fracture	13	--	6	2
Head Injury	24	--	--	--
Other**	--	--	2	--
TOTAL	146	57	51	23

*Myers did not specify what constituted a "Soft Tissue" injury.

**Myers did not specify the types of injuries which were included under the heading of "Other".

Sugerman (39) conducted a study in Australia looking at schoolboy rugby injuries in 33 schools. Ligament and joint sprains were by far the most common injury seen followed by fractures, muscle and tendon strains, deep contusions, and wounds and concussions in that order. Sugerman compared the results of his study to studies that examined the incidence and nature of rugby injuries in adults, and concluded that the incidence of severe injuries in schoolboy rugby was very slight.

Roux et al (34) found the most common injury afflicting the South African schoolboys serving as subjects for their study, to be fractures, representing 27% of all injuries seen. The other types of injury seen and their relative incidence are presented in Table IX.

Table IX
Relative Incidence of the Different Types of Injury
[from Roux et al (34)]

Type of Injury	Injury Incidence (%)
Fracture	27%
Ligament/Tendon	25%
Muscle Injury	17%
Concussion	12%
Dislocation	10%
Bone Bruising	6%
Internal Injuries	3%

The Etiology of Rugby Injuries

All authors discussed the etiology of rugby injuries in their study. Nathan et al (29) found that either being tackled (25%) or performing a tackle (22%) were the two most dangerous phases of play. Injuries as a result of the scrum (18%) and open play (11%) followed closely. Few injuries, in fact only 4% of those seen, occurred as a result of a line-out. Foul play accounted for only 8% of all injuries sustained by the schoolboys. This figure was much lower than figures published for all injuries occurring due to foul play during adult senior rugby by Wessels (40%), Roy (34%) and Davies and Gibson (31%) (9,35,44).

Roy (35) in his study at Stellenbosch University also found the tackle to be the most dangerous phase of play. Injuries arising from the tackle most commonly affected the face, knee and ankle. The "tackle" category included injuries sustained whilst the player was tackled with the ball, tackled without the ball, or performing the tackle.

Reilly and Hardiker (32) published the following results regarding the mechanisms of injury observed in two rugby teams in Liverpool, England (Table X). They felt the large number of injuries associated with rucks and mauls supported assertions of illegal practices in these two phases of play.

Table X
Summary of Contextual Mechanisms of Injury in Rugby Competition
[from Reilly and Hardiker (32)]

Game Context	Total Injury Number	Percentage
Ruck/Maul	64	45.10
Being Tackled	24	16.90
Tackling	23	16.20
Other*	13	9.15
Scrum	13	9.15
Lineout	5	3.50
TOTAL	142	100.00

*Reilly and Hardiker did not define which activities, or phases of the game were represented by the term "Other".

Inglis and Stewart (17) found a full 469 of the 1066 injuries they saw at the Accident and Emergency Department at Christchurch Hospital to have been sustained in the tackle. The ruck/maul situation accounted for a further 334 injuries with running in open play (101), the scrum (48), and line-out (23) also featured in terms of number of injuries seen. The authors noted with surprise the high incidence of injury associated with the tackle. They felt coaching aimed at technique improvement might help reduce injuries occurring as a result of the tackle, mauls and scrum collapse.

Sugerman (39) found the Australian schoolboy subjects in his study to be most commonly injured in the tackling phase of the game. In fact, almost 50% of the 574 injured schoolboys were either injured performing or receiving a tackle. The ruck, contributing 91 of 574 (16%) injuries, was also a danger area identified by Sugerman. Similar to other study findings, activities such as running, the line-out, and mauling contributed slightly lower incidences of injury.

Roux et al's (34) findings regarding the etiology of injury were summarised concisely in Table XI.

Table XI
Incidence of Injury During the Different Phases of Play
[from Roux et al (34)]

Phase of Play	Injury Incidence* (%)
Being Tackled	30
Tackling	25
Loose Ruck/Maul	18
Open Play	8
Scrum	8
Foul Play	4
Line-Out	1

*Roux et al did not explain why their injury incidence percentages did not total 100%.

The notable features were that further vindication, if it was needed, was provided because this study showed that the tackle was the most dangerous phase of play. The four percent figure for injuries as a result of foul

play was slightly misleading, as the authors noted that a full 32% of all concussions suffered were the result of foul play. Overall, the authors concluded that the tackle and the loose ruck/maul situation produced the most severe injuries, namely fractures, bone bruising and concussions as compared to other etiological factors.

Summary

The literature reviewed consisted of a wide cross-section of studies in terms of study designs, subjects used, and geographical locations of the study. However, a number of features were consistently noted from one study to the next.

It would not be accurate to cite an overall incidence of injury for rugby due to the influence of many extrinsic factors, and the fact that many authors used different units when describing the incidence of injury found in their study. This feature made comparisons of the results of one study to another difficult. In an attempt to give the reader an insight into the relative incidence of injury in rugby as compared to other sports, a table from Smodlaka (37) is included (Table XII).

The most notable feature regarding the nature of rugby injuries uncovered in the course of the literature search, was the high rate of head and neck injuries,

Table XII
Injuries for 100 Athletes Per Year
[from Smodlaka (37)]

Sport	Incidence of Injuries per 100 Athletes*
Motorcycle Sports	7.31
Rugby	6.41
Soccer	4.18
Boxing	3.20
Winter Sports	1.31
Track and Field	0.45

*These figures were provided by an Italian Insurance firm.

consisting mainly of lacerations. Fractures were most prevalent in some studies and some authors felt the nature of the playing surface had an influence on the number and site of the fractures seen, ie. the hard Australian grounds produced a higher incidence of upper limb fractures.

A disturbing feature was the high number of concussions seen in schoolboys. The incidence of concussion decreased as the age of the study subjects increased.

Overall however, as might be expected in a game such as rugby, the lower limb was consistently the most frequently injured part of the body. More specifically, ankle sprains, knee joint injuries and quadriceps contusions were seen regularly.

The information in the literature regarding etiology of rugby injury was in almost total agreement

that the tackle was the single most dangerous phase of the game. Players were injured almost equally as often, if they were performing or receiving a tackle. The loose ruck/maul situation also proved to be the cause of a large number of injuries.

Authors suggested that the incidence of injury resulting from both of the above-mentioned phases of the game could be reduced if the coaches concentrated on teaching players the correct technique they should use in these two situations (29,34,35).

A dissappointing feature of the literature search was that some authors neglected to present data or discussions regarding the etiological aspects of their study findings.

CHAPTER III. METHODS AND PROCEDURES

Methods

Rugby Injury Report Form. To investigate the etiology, nature and incidence of injury in the 1988 Auckland Division I Senior Club Rugby competition in New Zealand, the survey technique was chosen. A questionnaire (Appendix A) was designed specifically for this study after a careful examination of previous studies (10,19,33) and relevant literature (5).

The questionnaire, or rugby injury report form, was three pages in length and subdivided into five sections. Section A recorded the injured player's name, address, team and date on which the injury was sustained. In Section B, the player's age, height and weight were recorded. The player's previous senior club rugby experience, and player position when injured were recorded in Section C. Section D recorded the body region injured, the nature of the injury, the specific activity resulting in injury, as well as the field conditions and stage of the game and season that the injury occurred. Section E recorded additional information regarding the injury, such as who initially tended the injury and whether or not the injury was an

aggravation or recurrence of a previous injury. A copy of an instruction sheet that accompanied each report form is included in Appendix B. The purpose of the instruction sheet was to provide a brief introduction to, and an explanation of the study and to provide concise instructions on how the questionnaire was to be completed.

Nature of the Sample. The sample consisted of approximately 250±20 Senior Club rugby players representing their respective teams in the Auckland Rugby Union's Division I competition in New Zealand. The season was of 20 weeks duration, beginning in mid-April and ending in early August of 1988. The size of the sample was based on the number of players each coach was likely to have had in his squad for the duration of the season.

Games are played every Saturday afternoon for the 20 week season. By convention, all teams practice on Tuesday and Thursday evenings, with some teams having an additional practice on Wednesday.

The Auckland Rugby Union's Division I competition is widely recognized as the most competitive club rugby competition in New Zealand. All of Auckland's representative players participate in the competition as well as a large number of players who are either past or present New Zealand representatives. In addition, a

number of overseas players from England, Ireland, Wales, France, Scotland, Italy and Canada play for various clubs in the competition.

Procedures

Approval was sought from the President of the Auckland Rugby Union and the respective team coaches to conduct the study. Once this approval had been granted, the Rugby Injury Report Forms together with the instruction sheets were distributed to the physiotherapist or trainer of every side (team). They were asked to provide the injured player with a report form as soon as possible after an injury was sustained. The injured player, in conjunction with the physiotherapist or trainer then completed the form. The form was retained by the physiotherapist or trainer, and completed forms were collected from each team on a weekly basis by the author. The forms were checked for accuracy and completeness at the weekly pick-up so additions could be made by the player and physiotherapist or trainer if necessary.

Data Analysis

The data collected was fed into an IBM computer and analysed using a PC Statistician program that provided information regarding frequencies in all categories surveyed. The results are presented in a tabular form

displaying information under a number of headings that best illustrates information regarding the etiology, nature, and rate of injury seen. Based on the results, a number of points and recommendations were made to make the study of maximal benefit to coaches, trainers and players alike.

As this study was descriptive in nature, it was felt that a detailed statistical analysis was not appropriate.

CHAPTER IV. RESULTS

The results presented below were derived from the data obtained from the 57 rugby injury report forms collected during the course of the study. The variables were discussed in the order in which they appear on the injury report form.

Incidence

During the 1988 Auckland Club rugby season, approximately 250±20 players were involved in senior club rugby. Of this total, 43 different players were injured, with eight players being injured on two separate occasions and three players sustaining injuries three times. In addition, three players sustained two injuries at the same time. The two injuries were recorded on one injury report form. Thus, the total number of rugby injuries surveyed was 60.

The incidence of injury, obtained by dividing the number of injuries sustained over the whole season by the number of players participating, was 24%.

Age and Previous Senior Club Rugby Experience

The injured players ranged in age from 19 to 34. The average age of the injured players was 25. Only

four (7%) of the injured players were under 20, and only five (8.8%) were over 30. The average amount of senior club rugby experience was 4.9 seasons. Seven (12%) of the injured players were first-year players, whilst five (8.8%) of the players had ten or more seasons of senior club rugby experience.

Height and Weight of the Injured Players

The average height of the injured players was five feet and eleven inches (1.78 meters). The average weight of the injured players was 189 pounds (86.0 kilograms).

Playing Position

Thirty-five (58.3%) of the injuries were sustained by forwards, and the remaining 25 (41.7%) by the backs. The frequency of injury for specific positions is listed in Table XIII.

Of the injured players, 96.5% were playing in their regular position at the time of injury, thus non-regular playing position was only associated with two (3.5%) injuries. In both cases, the injured player was a back who had exchanged positions with another back on the same team. The reasons for the positional changes were not given.

Table XIII
Frequency of Injury Related to Playing Position in Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season

Position	Frequency of Injury	Percentage of Total Injuries
Openside Flanker	8	13.3%
Tighthead Prop	8	13.3%
Blindside Flanker	7	11.7%
Centre	5	8.3%
Fullback	5	8.3%
Left Wing	5	8.3%
Halfback	4	6.7%
Number Eight	4	6.7%
Hooker	3	5.0%
Second Five-Eighth	3	5.0%
Left Lock	2	3.3%
Right Lock	2	3.3%
First Five-Eighth	2	3.3%
Right Wing	1	1.7%
Loosehead Prop	1	1.7%
TOTAL	60	100.0%

Body Regions Injured

The frequency of rugby injury related to the various body regions is shown in Table XIV.

Table XIV
Frequency of 60 Injuries Related to Body Region in Rugby Players Injured in the 1988 Auckland Senior Club Rugby Season

Body Region Injured	Frequency of Injury	Percentage of Total Injuries
Lower Limbs	34	56.7%
Trunk	11	18.3%
Upper Limbs	9	15.0%
Head	6	10.0%
Neck	0	0.0%
TOTAL	60	100.0%

Type of Injury

The various types of rugby injuries reported and their relative frequency are shown in Table XV.

Table XV
Frequency of Different Types of Injury Sustained by Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season

Type of Injury Sustained	Frequency of Injury	Percentage of Injuries
Ligament Sprain	16	26.7%
Muscle or Tendon Strain	14	23.3%
Muscle Contusion	8	13.3%
Fracture	7	11.7%
Dislocation	4	6.7%
Laceration	3	5.0%
Concussion	2	3.3%
Joint Bruise	2	3.3%
Lumbar Injury	2	3.3%
Bone Bruise	1	1.7%
Internal Injury	1	1.7%
Blisters and Abrasions	0	0.0%
Orofacial Injury	0	0.0%
TOTAL	60	100.0%

Relationship Between Site and Nature of Injury

The results demonstrating the relationship between the site of injury and nature of injury are presented in Table XVI.

Relationship Between Specific Activity Resulting in Injury and Type of Injury

The majority of the injuries sustained whilst being tackled were quadriceps contusions (25%), knee ligament sprains (20%), and ankle ligament sprains (10%).

Table XVI
The Relationship Between the Site of Injury and Nature of Injury in Rugby Players Injured in the 1988 Auckland Senior Club Rugby Season

Nature of Injury	Lower Limb	Trunk	Upper Limb	Head and Neck
Ligament Sprain	13	2	1	--
Muscle or Tendon Strain	12	2	--	--
Muscle Contusion	7	1	--	--
Fracture	--	2	4	1
Dislocation	1	--	3	--
Other	3	3	--	5
TOTAL	36	10	8	6

The most common injuries sustained whilst performing a tackle were concussions (33.3%).

Running in open play resulted almost exclusively in lower limb injuries in the form of muscle and tendon strains (40%) and ligament sprains (20%).

Specific Activity Resulting in Injury

The frequencies of injury from specific activities are presented in Table XVII.

Relationship Between Playing Position and Type of Injury

The tighthead props were one of the two positions that were injured most frequently. The majority of the injuries sustained by the tighthead props were muscle or tendon strains (62.5%).

Table XVII
Frequency of Injury Related to Specific Activities Resulting in Injury in Rugby Players Injured During the 1988 Auckland Senior Club Rugby Season

Specific Activity Resulting in Injury	Frequency of Injury	Percentage of Injuries
Being Tackled	20	33.3%
Running in Open Play	15	25.0%
Collapsed Ruck or Maul	9	15.0%
Performing a Tackle	6	10.0%
Foul Play	5	8.3%
Collision of Heads	3	5.0%
Collapsed Scrum	1	1.7%
Other	1	1.7%
Kicking the Ball	0	0.0%
TOTAL	60	100.0%

The left wings were one of the three positions sustaining the most injuries amongst the backs. Of the injuries sustained by left wings, 40% were ankle ligament sprains.

Stage of Season and Game

The incidences of injury in each quarter of the season are presented in Table XVIII. In addition, the distribution of injury occurring with respect to the stage of the game is given in Table XIX.

Field Conditions

The largest percentage of injuries (60%) occurred on hard and dry fields. Field conditions that were

Table XVIII
Frequency of Injury Related to Stage of Season for Rugby Players Injured During the 1988 Auckland Senior Club Rugby Competition

Stage of Season	Frequency of Injury	Percentage of Injuries
First Quarter	18	30.0%
Second Quarter	23	38.3%
Third Quarter	14	23.3%
Fourth Quarter	5	8.4%
TOTAL	60	100.0%

Table XIX
Frequency of Injury Related to Stage of Game for Rugby Players Injured During the 1988 Auckland Senior Club Rugby Competition

Stage of Game	Frequency of Injury	Percentage of Injuries
First Quarter	16	26.7%
Second Quarter	17	28.3%
Third Quarter	18	30.0%
Fourth Quarter	9	15.0%
TOTAL	60	100.0%

predominantly wet and soft accounted for the remaining 40% of injuries.

Aggravation of Previous Injury

Ten (16.7%) of the injuries were aggravations of previously sustained injuries. The remaining 50 (83.3%) injuries were not as a result of an aggravation of a previous injury.

In addition, three (5.0%) of the injuries were sustained whilst a player was recovering or suffering from a previously sustained injury.

Use of Mouthguards

Of the injured players, 48 (80%) were wearing a mouthguard at the time of injury.

First Aid

First aid supplies were immediately available for 58 (96.7%) of the injured players.

Provision of Initial Assessment and Treatment of Injury

A summary of the personnel providing the initial assessment and treatment of the injuries sustained by the rugby players is provided in Table XX.

Table XX
Frequency With Which Various Team Personnel Provided Initial Assessment and Treatment of Injuries Sustained by Players During the 1988 Auckland Senior Club Rugby Season

Team Personnel	Frequency of Injury	Percentage of Injuries
Physiotherapist	22	36.7%
First Aid Volunteer	13	21.7%
Doctor	12	20.0%
Trainer	9	15.0%
Manager	4	6.6%
TOTAL	60	100.0%

CHAPTER V. DISCUSSION

The results presented in this study represent the serious injuries sustained by the players in the 1988 Auckland Senior Club Rugby Competition in New Zealand. However, due to the changes in team composition over the season due to injuries, fluctuations in playing performances and player unavailability, it was difficult to determine the actual number of participants studied. It was felt that 250±20 participants was an accurate estimation based on the number of teams and size of player squads generally used by each club.

The total number of injuries reported during the course of this study was less than the number of injuries reported in many of the other studies reviewed. Roy (35) published a study in 1974 based on 300 rugby injuries that occurred during the 1973 season at Stellenbosch University in South Africa. In contrast, Reilly and Hardiker (32) published a study in 1981 examining injuries in adult student rugby football. They discussed 32 serious injuries in addition to the minor injuries they observed in the teams they studied for a season.

Incidence of Injury

The incidence of injury found in the present study (24%) could not be compared to most other studies of rugby injuries, as a study of this type looking at the etiology, nature and incidence of injury over a full season had not been undertaken before. In addition, a number of authors have expressed incidence of injury in terms of injuries per player-hours. This unit of injuries per player-hours does not take into account replacements made during the game, thus possesses an inherent inaccuracy.

However, Walkden (42) calculated that 10% of the players who played rugby at the Twickenham Rugby Ground in England from 1964-1975 were injured. All levels of rugby were played at Twickenham over the ten seasons, from schoolboy games to International matches. Therefore, a direct comparison between Walkden's incidence of injury and that of the present study cannot be made due to the disparity in player populations between the two studies.

Player Characteristics

There was no knowledge of the population characteristics of the present study, so no comparison could be made between the age, playing experience, height and weight of the injured players and the age, playing

experience, height and weight of the general population of rugby players. In the opinion of this author, the age, playing experience, height and weight characteristics of the injured players were representative of the general population of rugby players participating in the Auckland Senior Club Rugby Competition.

Playing Position

The results obtained in the present study regarding incidence of injury for the different playing positions were similar to other studies (2,32,35). The present study found that forwards were injured more frequently than backs and this finding was supported by the literature (26,29).

The tighthead props and openside flankers were the players who were injured most frequently. This finding supported the results of Addley and Farren (2), who in an Irish rugby injury survey found the openside flankers to be most commonly injured. The high injury rate of the openside flankers could likely be attributed to the nature of the position which encourages an aggressive, fast, and constantly involved style of play (2).

Of the backs, the left wings, centres and fullbacks were most commonly injured. Again, the relatively high injury rates of these positions were likely to be a function of the requirements of the position, namely to

run with the ball at full speed or to tackle an opposite player who is also running at full speed. This tackling at full speed occurred especially to the wings and fullbacks as they were often faced with more open space around them when they were involved in play.

Further discussion of the role of playing position in injury will be discussed under "Types of Injury".

Body Regions Injured

The lower limbs were injured more frequently than the trunk, upper limbs, and head and neck. These results were supported by all studies reviewed (1,3,9, 31,38,43), with the exception of an Australian study (8), which found a higher incidence of upper limb, and head and neck injuries, than trunk or lower limb injuries. Sparks (38) suggested the reason that Davidson found a higher incidence of upper limb and head and neck injuries, than lower limb and trunk injuries, is that the grounds in Australia where Davidson conducted his study tended to be much drier and harder than those found in Britain, thus potentially predisposing to more cases of concussion and upper limb fracture.

The proportion of head and neck injuries in this study is lower than most of the other studies reviewed (1,3,8,9,31,38,43). In the opinion of this author, this difference resulted because a player who had suffered a

laceration or concussion during a Saturday game may have recovered sufficiently to participate at practice on Tuesday. Thus, despite suffering an injury, the injured player would not qualify for inclusion in the present study as he did not miss the Tuesday practice immediately following the game in which he was injured. In contrast, the injured players who qualified for Walkden's study (42) were assessed immediately following the game in which they were injured, meaning they were more likely to be classified as having sustained a rugby injury.

Type of Injury

The most notable difference between the most common types of injury seen in this study and other studies reviewed, was that the number of concussions and lacerations seen in the present study was much less than in other studies (26,28,29). The reasons for this have been discussed previously under "Body Region Injured".

The proportion of fractures seen in the present study was similar to the proportion of fractures seen in other New Zealand and British studies (17,38,42). However, the proportion of fractures seen in some Australian and South African studies was much higher (8,34). In the opinion of this author, the higher proportion of fractures seen in some of the Australian

and South African studies was due to the predominantly dry and hard grounds the matches were played on in these two countries. Sparks (38) stated that he felt hard and dry grounds predisposed to a higher number of fractures, when he discussed the results of an Australian study by Davidson (8).

Some studies have grouped muscle contusions, and muscle and tendon strains together under one heading. Nathan et al (29) and Roux et al (34) used the term "Muscle Injuries", for both contusions, and muscle and tendon strains. Myers (28) grouped muscle contusions, and muscle and tendon strains under the heading "Soft Tissue" injuries. In the present study, muscle contusions, and muscle and tendon strains were not grouped together under a common heading. The reason is that this author was interested in determining more specifically what type of muscle injuries were being sustained by rugby players. The literature reviewed suggested that the number of muscle strains suffered by sportsmen could be reduced by flexibility work, as studies by Nicholas (30) and Glick (15) suggested people with tight muscles were more susceptible to muscle strain. In addition, studies of hamstring strains have shown that a weak muscle is more susceptible to injury and the authors suggested preventative measures could include more strengthening, assuming either muscle

weakness or muscle imbalances were the problem (15,16). No studies examining measures to reduce the number of muscle contusions in rugby players could be found in the literature. The primary reason for this lack of preventative measures is that rugby players are not allowed to wear any protective equipment.

Specific Activity Resulting in Injury

The finding in the present study that being tackled was the activity that resulted in the most injuries, has been reported by a number of other authors (17,29,34,35,39). Inglis and Stewart (17) noted with concern the high incidence of injury associated with the tackling phase of the game. They felt coaching aimed at technique improvement might help reduce the number of injuries occurring as a result of the tackle. This view was endorsed by other authors (29,34,35).

Injuries occurring as a result of foul play (8.3%) were less frequent than the 31%, 34% and 40% incidence of injury as a result of foul play reported by Davies and Gibson (9), Roy (35) and Wessels (44). It appears the stand of administrators and referees in Auckland against foul play was being upheld, and as a result, comparatively few injuries as a result of foul play were seen.

Collapsed rucks and mauls were the cause of a small percentage of all injuries, with no predominant type of

injury from this phase of play being evident. Recent rule changes have been made by the International Rugby Board requiring referees to stop play quickly when it appears as if the ball is trapped and not about to come free in a ruck or maul situation. These rule changes may be an important factor in the reduction of injury. As this study was conducted only after the rule changes had been implemented and not before, the results from this study cannot be used to either support or discredit the rule changes. If similar data on injuries had been collected before the recent rule changes, the effect of rule changes could have been better documented.

Stage of Season and Game

More injuries occurred at the beginning, than at the end, of the season. Nathan et al (29) reported similar findings which they attributed to a lack of early-season "match fitness". Thus, they suggested more attention should be paid to pre-season conditioning. This view was endorsed by both Tooth (40) and Vanderfield (41), who stated that improved physical fitness as attained via a pre-season conditioning program was accepted as a method of injury prevention.

Early in the season in New Zealand the grounds tended to still be dry and hard after the summer, so this ground state may help explain the higher incidence of injury for the first half of the season as compared

to the second half of the season, by which time rain and continued use had softened the grounds. The effect of different ground conditions on rugby injuries will be discussed further under "Field Conditions".

The frequency of injury was consistent over the first three quarters of the game, but the frequency of injury dropped substantially for the final quarter of the game. This author felt that the frequency of injury for the final quarter would have been higher than the preceding three quarters of the game if fatigue had been an important etiological factor in rugby injuries. However, the results of this study did not support this hypothesis. In fact, the effect of fatigue in the final quarter of the game may have resulted in a reduction in the speed and intensity of play resulting in a lower incidence of injury.

Records of the scores of the games might have provided information on the potential intensity of the game over the four quarters, particularly during the final quarter of the game. However, records of the scores of the games in which players were injured were not kept, thus the effect of the score on the frequency of injury per quarter cannot be discussed.

Field Conditions

The largest percentage of injuries occurred on hard and dry fields as opposed to fields that were wet and

soft. Data regarding the number of games played on different surfaces was not kept, but it is the opinion of this author that hard and dry grounds predispose to a higher incidence of injury as compared to wet and soft grounds. This view was endorsed by Davidson (8) and Sparks (38). The higher incidence of rugby injury for the first half of the season when the grounds are hard and dry has been discussed earlier under "Stage of Season and Game". The high incidence of injury for the first half of the season, as compared to the second half of the season when the grounds are more likely to be wet and soft, gives further support to the hypothesis that hard and dry fields result in a higher incidence of injury.

Playing Position Related to Type of Injury

The forwards were more susceptible to muscle and tendon strains than the backs. Rugby players are notorious for not being very conscientious in regard to stretching or any form of flexibility work, but it appears to be important for this group of sportsmen to address the issue of flexibility and strengthening of vulnerable muscle groups to decrease the incidence of injury (15).

The tighthead props were one of two positions that sustained the most injuries. The majority of the injuries sustained by the tighthead props were muscle

strains. As discussed earlier under "Type of Injury", preventative measures such as increased flexibility work and muscle strengthening have been suggested by some authors (15,16,30) as being beneficial in reducing the incidence of muscle strain. It is the opinion of this author, based on the results of the present study, that the tighthead props and other players would benefit from preventative measures aimed at reducing the number of muscle strains.

The left wings were one of the three positions sustaining the most injuries amongst the backs. In particular, the left wings suffered a large number of ankle ligament sprains. It would seem that prophylactic ankle taping could be beneficial for players who are considered at risk (i.e., have sustained a previous ankle sprain) or perhaps for all players in general. This view was supported by Ekstrand (13), who found that prophylactic ankle taping in soccer players significantly reduced the number of ankle sprains, particularly in those who had sustained a previous ankle sprain. The results of this study are applicable to rugby as the two sports of rugby and soccer are very closely related as suggested by Micheli and Riseborough (22), due to the development of rugby from the game of soccer. Another study by Garrick and Requa (14) found that prophylactic ankle taping in college basketball

players decreased the frequency of ankle sprains. This decrease was particularly marked in those subjects who had suffered previous ankle sprains.

Type of Injury Related to Site of Injury

The majority of the ligament sprains were to the joints of the lower limbs. Myers (28), had also found the majority of the ligament sprains seen in his Australian study were to the joints of the lower limbs. More specifically, the ankle ligaments were the ligaments most commonly sprained in the present study. Possible preventative measures aimed at reducing the incidence of ankle ligament sprains have been discussed earlier under "Playing Position Related to Type of Injury".

It was presumed that calf and hamstring strains would predominate in the muscle and tendon strain category, due to the amount of running associated with the game of rugby. The results supported this hypothesis. Secondly, muscles that activate or cross two joints and muscles of short action such as the triceps surae and hamstrings are more vulnerable to muscle strains as suggested by Glick (15).

Specific Activity Resulting in Injury Related to Type of Injury

The majority of injuries sustained whilst being tackled were to the lower limbs in the form of

quadriceps contusions, knee ligament sprains and ankle ligament sprains. These results were supported by Roy (35). The preceding results are to be expected, as most players tend to tackle around the opposing player's waist or legs; as in the opinion of this author, this method of tackling appears to be the most effective in halting the progress of the opposition player.

Of those players injured whilst performing a tackle, a number sustained concussions. It is commonly accepted amongst players and coaches that a well executed tackle should not result in a concussion to the player performing the tackle. A concussion usually results from the player's inability to position his head so that the majority of the force of the tackle is absorbed by his arms and shoulders, as opposed to his head.

This author agrees with the opinion expressed earlier under "Specific Activity Resulting in Injury" by Inglis and Stewart (17) that stated that efforts by players and coaches to improve tackling technique may result in a lower incidence of injury associated with this phase of the game. This author has observed over the last few seasons, that more teams are incorporating tackling drills into their training sessions with the aim of improving tackling proficiency, and reducing the incidence of injury associated with tackling. As this

study was only conducted over the most recent senior club rugby season in Auckland, the findings of this study cannot be used to evaluate the effectiveness of the increased emphasis on tackling technique that has been observed at team practices over recent seasons.

Running in open play resulted almost exclusively in lower limb injuries. This finding was expected due to the amount of running associated with the game of rugby as discussed earlier under "Type of Injury Related to Site of Injury". Possible preventative measures such as more flexibility work, muscle strengthening, prophylactic ankle taping and an increased emphasis on pre-season physical conditioning as advocated by various authors, have been discussed previously (13,14,15,16,30).

Provision of Initial Assessment and Treatment of Injury

In a small number of cases, the injury was initially attended to by the team manager. Theoretically, the team managers should not have attended to the injured players, as it was the policy of the Auckland Rugby Union to have medical personnel in attendance at all senior club rugby matches in Auckland.

Use of Mouthguards

Mouthguard use was not mandatory, but it appears as if more and more players were following the advice of doctors, trainers and coaches to wear mouthguards during

practices and games. A recent study by Chapman (7) suggested that oral and dental injuries could be almost totally avoided by the use of a protective apparatus such as a mouthguard. With the exception of a nasal fracture as a result of a punch, no orofacial injuries were reported, even amongst those players who did not wear a mouthguard.

Practical Implications

No data was available regarding the flexibility of the injured players. However, based on the results of this study and opinions expressed by various authors in the literature (15,30), this author advocates the introduction of pre-season and in-season flexibility exercises for all players, with emphasis on the muscle groups of the lower limbs.

It appears from the results of this study that pre-season conditioning for all players warrants further attention from coaches and trainers concerned with reducing the incidence of injury during the early stages of the season. This view was endorsed by a number of authors (29,40,41).

Finally, it was apparent that the tackle was the most dangerous phase of the game of rugby as shown by the present study and previous studies (17,29,35,39). The possible solution to the high incidence of injury associated with tackling appears to be increased

emphasis on improving tackling technique as suggested by various authors (29,34,35) and endorsed by this author.

Suggestions for Further Study

It would have been beneficial to have had information regarding the player characteristics of the general population of rugby players participating in the 1988 Auckland Division I Senior Club Rugby Competition. If this information had been available, direct comparisons between the injured and uninjured players could have been made. The results of this comparison may have revealed data that could have been useful in identifying further etiological factors with respect to rugby injuries.

The Auckland Rugby Union was opposed to the collecting and analysis of any data regarding the etiology, nature and incidence of rugby injury associated with specific teams, games or referees. This author found this restriction disappointing, as again further information with respect to rugby injuries in the 1988 Auckland Division I Senior Club Rugby Competition may have been missed.

Finally, this author feels that if the study had been extended over a number of seasons in a similar manner to the studies by Sparks (38) and Walkden (42), then greater emphasis could be placed on the results of the study. In addition, the effects of rule changes,

altered training techniques and improved physical conditioning by the players could be better gauged from a long term study. The number of injuries seen from a study conducted over a number of seasons would be far greater than the number of injuries in the present study. Thus, injury patterns and relationships would be less likely to be overlooked in a long term study.

Recommendations

The results of this study suggest that a large number of injuries could have been prevented through the cooperation and actions of the coaches, trainers and players.

1. Pre-season medical and physical examinations should be compulsory prior to the commencement of each season before each player participates in practices and games. The medical and physical examination should take into account the forces and stresses involved in the game of rugby, and more specifically, those stresses and forces encountered as a result of the position played by the individual.

2. The coaches and trainers involved with conditioning should emphasize the importance of an off-season maintenance program which slowly increases in intensity as the season approaches. With this program instituted, the players would be more likely to be physically prepared for pre-competition trials and games as well as

the demands of early-season competition play. Emphasis should be placed on the strength and flexibility of the lower limbs to aid in the prevention of lower limb muscle strains.

3. Practices in the pre-season and early-season should include instruction relating to correct tackling technique and body positioning in rucks and mauls. A minimum of contact should be used initially and then increased gradually as concepts are understood and techniques mastered.

4. Forwards were injured more frequently than backs, thus, it would appear crucial to place more emphasis on conditioning and technique improvement in this group of players.

5. Despite the fact that most players already wear mouthguards, their use should be made mandatory to help minimize orofacial injury, and the incidence and severity of concussions.

6. Ankle taping for practices and games should become more widespread, especially in those players who have had previous ankle injuries. Knee taping for selected conditions may also be beneficial, and thus, recommended.

CHAPTER VI. SUMMARY AND CONCLUSIONS

Purpose

The purpose of this study was to determine the etiology, nature and incidence of injury in the Auckland, New Zealand, Division I Senior Club Rugby Competition over the 1988 season.

The subjects were the approximately 250 players who played for the 12 teams in the Division I Senior Club Rugby Competition. Of the 250 players, 57 were injured totalling 60 separate injuries.

A rugby injury report form was designed specifically for the study (see Appendix A). This form was supplemented by a instructional pamphlet (see Appendix B) that accompanied the injury report form. Physiotherapists, doctors and trainers associated with the various teams completed the forms in conjunction with the injured players. The forms were collected at least every two weeks, and checked for completeness and accuracy by the author.

At the completion of the season, the data was transferred from the injury report forms to an IBM PC Statistician™ package to determine frequency of injury in different categories.

Analysis of the data showed the overall incidence of injury was 24%. The injury incidence was higher for the first half of the season and progressively reduced over the final two quarters of the season. Tighthead props and openside flankers followed by blindside flankers, left wings and fullbacks received more injuries than players of other positions. Overall the forwards were more frequently injured than the backs.

The average age of the injured players was 25. Forty-three different players received a total of 60 injuries. Eight players were injured on two separate occasions and three players sustained injury on three separate occasions. Also, three players sustained two injuries at the same time which were recorded on one injury report form.

The most prevalent injuries, expressed as percentages, were: ligament sprains (26.7%), muscle and tendon strains (23.3%), muscle contusions (13.3%), and dislocations (6.7%). Of the ligament sprains, 43.8% were to the ankle and 37.5% were to the knee.

Calf strains (28.6%) and hamstring strains (21.4%) were the predominant type of injury comprising the muscle and tendon strains. Quadriceps strains and adductor strains each represented 14.3% of the injuries in this category. A total of seven fractures were seen, four of which were to the wrist and hand. One fractured

clavicle occurred and the only fracture attributed to foul play was a nasal fracture.

With the exception of a nasal fracture as a result of a punch, no serious orofacial injuries were reported and 78.4% of the injured players indicated they were wearing a mouthguard at the time of injury.

Only three players were injured whilst suffering or recovering from a prior injury. In addition, only 17.5% of the injuries were recurrences or aggravations of previous injuries.

Of all the injuries, 93% were immediately attended by a physiotherapist (35.1%), a St. John's First Aid volunteer (22.8%), a doctor (21.1%) or a trainer (14.0%). In only two instances were first aid supplies not immediately available.

Conclusions

Within the limitations of this study, the following conclusions have been made:

1. Tighthead props and openside flankers were injured more frequently than players in any other position.
2. Forwards had a higher incidence of injury than backs.
3. The legs were the most common site of injury. More specifically the ankle and knee were the most frequently injured joints, respectively.

4. The most common type of injury was ligament sprains. The most common site of ligament injury was the ankle.

5. Being tackled produced the highest number of injuries. Players performing a tackle also sustained injuries making the tackle the most dangerous phase of the game.

6. Running in open play produced the largest number of muscle and tendon strains as compared to any other phase of play.

7. The incidence of injury was higher for the first half of the season.

8. Hard and dry grounds resulted in a higher number of injuries.

9. Only a small percentage of injuries were either aggravations of previous injuries, or sustained while the player was recovering from a previous injury.

10. First-aid supplies and trained personnel were available immediately to virtually all injured players.

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APPENDIX A

Rugby Injury Report Form

AUCKLAND DIVISION I SENIOR CLUB RUGBY

INJURY REPORT FORM

A. Name of Player _____ Date _____

Home Address _____ Phone (Work) _____

_____ (Home) _____

Game Details: Team _____ Opposition _____

Score: Result ( ) Win ( ) Loss ( ) Draw

Referee _____

Tick the one (or more) appropriate items from the following sections:

B. Age (years):

( ) 17 and under	( ) 21	( ) 25	( ) 29	( ) 33
( ) 18	( ) 22	( ) 26	( ) 30	( ) 34
( ) 19	( ) 23	( ) 27	( ) 31	( ) 35
( ) 20	( ) 24	( ) 28	( ) 32	( ) 36 & over

Height (feet):

( ) 5'0" and under	( ) 5'5"	( ) 5'10"	( ) 6'2"	( ) 6'6"
( ) 5'1"	( ) 5'6"	( ) 5'11"	( ) 6'3"	( ) 6'7"
( ) 5'2"	( ) 5'7"	( ) 6'0"	( ) 6'4"	( ) 6'8"
( ) 5'3"	( ) 5'8"	( ) 6'1"	( ) 6'5"	( ) 6'9" & over
( ) 5'4"	( ) 5'9"			

Weight (pounds):

( ) under 120	( ) 150-159	( ) 190-199	( ) 230-239	( ) 270-279
( ) 120-129	( ) 160-169	( ) 200-209	( ) 240-249	( ) 280-289
( ) 130-139	( ) 170-179	( ) 210-219	( ) 250-259	( ) 290-299
( ) 140-149	( ) 180-189	( ) 220-229	( ) 260-269	( ) 300 & over

---

C. Previous Senior Rugby Experience:

( ) First year	( ) 4 years	( ) 8 years	( ) 11 years	( ) 14 years
( ) 1 year	( ) 5 years	( ) 9 years	( ) 12 years	( ) 15 years
( ) 2 years	( ) 6 years	( ) 10 years	( ) 13 years	( ) 16 years or more
( ) 3 years	( ) 7 years			

Player Position When Injury was Sustained:

( ) Prop (tighthead) ( ) Hooker ( ) Prop (loosehead)

( ) Lock L ( ) Lock R

( ) Flanker (blindside) ( ) Flanker (openside)

( ) Number Eight

( ) Halfback

( ) First Five-eight

( ) Second Five-eight

( ) Centre

( ) L Wing ( ) R Wing

( ) Fullback

Is this the player's regular position ? ( ) Yes ( ) No

Did the player sustain more than one injury? ( ) yes ( ) no

D. Body Region(s) Injured:

HEAD
( ) scalp
( ) skull
( ) eye
( ) nose
( ) cheek
( ) teeth
( ) ear
( ) jaw

TRUNK
( ) chest/ribs
( ) upper spine (ie. back of chest)
( ) upper back muscles
( ) lower spine (ie. back of abdomen)
( ) lower back muscles
( ) abdomen
( ) genitals

ARMS
( ) shoulder
( ) collar bone
( ) shoulder blade
( ) upper arm
( ) elbow
( ) forearm
( ) wrist
( ) hand
( ) finger

LEG
( ) hip
( ) thigh front
( ) thigh back
( ) inner thigh (ie. groin)
( ) knee
( ) lower leg
( ) ankle
( ) foot
( ) toe

NECK
( ) muscles
( ) spine
( ) throat

If other, please specify:

_____
_____
_____

Injury occured to ( ) left side of body, ( ) right side of body, ( ) neither, eg. nose

Nature of Injury:
( ) abrasion - removal of skin by mechanical means (scrape)
( ) blisters
( ) bone bruise - bruising of a bony area due to a direct blow
( ) bone fracture or crack
( ) concussion - temporary loss of orientation or consciousness
( ) dislocation or subluxation - joint deformity with loss of function
( ) injury to internal organs, eg. kidney, spleen, etc.
( ) joint bruise or swelling
( ) laceration, cut
( ) ligament sprain - strain or tear of ligament(s)
( ) muscle bruise - discoloration or swelling of muscular area due to a blow
( ) muscle or tendon - tear or pull of a muscle or tendon due to use rather than a direct blow
( ) nose bleed
( ) teeth - broken or loosened
( ) other - specify _____

Specific Activity Resulting in Injury:
( ) being tackled
( ) collapsed ruck, maul, pile-up
( ) collapsed scrum
( ) foul play
( ) kicking the ball
( ) performing tackle
( ) running in open play
( ) other - specify _____
_____

Stage of Season:

( ) first 1/4 of season ( ) third 1/4 of season
( ) second 1/4 of season ( ) final 1/4 of season

Stage of Game:

( ) first 1/4 of game ( ) third 1/4 of game
( ) second 1/4 of game ( ) final 1/4 of game

Field Conditions:

( ) wet ( ) dry ( ) muddy ( ) soft ( ) hard

E. Additional Information:

Is the injury an aggravation or recurrence of a previous injury? ( ) Yes ( ) No
If yes, how long ago did the initial injury occur? years ____
months ____

Was the player suffering from or recovering from another injury at the time this injury occurred? ( ) Yes ( ) No
If yes, specify _____

_____

Was the player wearing a mouthguard at the time of injury? ( ) Yes ( ) No

Who initially tended to the injury?
( ) doctor
( ) physiotherapist
( ) trainer
( ) St. John's volunteer
( ) other - specify

Were first-aid supplies available? ( ) Yes ( ) No

Remarks (information or circumstances not covered above):

_____
_____
_____
_____
_____

Name _____ Phone (Work) _____

(Home) _____

Signature _____

APPENDIX B

Rugby Injury Report Form
Instructional Pamphlet

RUGBY INJURY REPORT FORM

INSTRUCTIONAL PAMPHLET

A survey of Rugby injuries is being conducted over the 1988 season in the Auckland Division I Senior Club Rugby Competition.

The purpose of the study is to collect and analyze data so that possible causative factors of injury can be identified. The results can then be used by coaches, trainers and players alike to minimize the risk and severity of injury.

Please read the following brief points and the proceed to answer the questions on the following pages.

1. For this particular study, an Injured Player will be defined as:

"A player who misses a practice due to an injury sustained during the preceding game".

2. The injury report form should be filled out as soon as possible following the injury while the details of the injury are still clear.

3. The team Coach or Trainer should assist the athlete in completion of the injury report form where possible.

4. Place a tick (✓) only in those brackets providing the most appropriate answer(s) for each question. Please do this as accurately and carefully as possible. It should be noted that it may be necessary to provide more than one response to a question.

5. Once completed, the form should be retained by the Team Coach, Manager or Trainer. The forms will be collected weekly.

Should any problems or difficulties arise, please phone:

Nick Ewart (Home) 687-781
(Work) 278-6861